With the Author's Compliments.

(15)

UNUNITED FRACTURES IN CHILDREN.

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THE subject of fractures is one which has always had a peculiar interest for American surgeons, and the literature in connection with it is therefore very extensive. As I do not find that any surgeon has paid especial attention to ununited fractures occurring in children, I have thought it worth while to put a few notes together, which I hope may prove useful as well as interesting to those surgeons who are attached to children's hospitals, or are otherwise brought into frequent contact with children who have sustained injury.

Ununited fractures are undoubtedly rare in children, but nearly every surgeon who has much to do with the treatment of the surgical diseases of children can probably recall one, or perhaps more cases of non-union which have come under his notice. Some of them have been published in the various medical periodicals of the world, and I have recently been at the trouble of collecting and tabulating some of the more accessible.

In the unrivalled collection of cases of ununited fractures compiled by Dr. Frank Muhlenberg, and published in the first volume of Professor Agnew's *Principles and Practice of*

Surgery, no less than 685 cases are recorded and analysed. This table includes pseudarthrosis met with at all periods of life, and amongst them I find 28 cases occurring in children under ten years of age. Sir James Paget[1] records 3 cases which came under his own observation. From other sources I have been able to collect, more or less, full particulars of 40 cases, so that the total number which I have been able to gather together is 71.

This table I have recently had the honour of laying before the Fellows of the Royal Medical and Chirurgical Society of London, but it is too long to reproduce, and I will therefore only state the general conclusions which I deduced from it. Of the 71 cases, 7 occurred in the clavicle, 9 in the humerus, 12 in the femur, 42 in the leg, and only 1 in the forearm—a result which is very surprising when it is considered that statistics show the forearm to be more often broken than any other bone in a child's body. Ununited fractures are a little more commonly met with in girls than in boys; they are equally frequent on the right and left sides of the body. The most unsatisfactory point in connection with ununited fractures in children is the frequency with which all operative measures fail to effect union. Thus, of the entire number of 71 cases, firm bony union was only obtained in 6 children, whilst of the others some remained in their former condition, some received slight benefit from a very prolonged and often hazardous course of treatment, whilst others, as was too often the case, underwent that "opprobrium of surgery," amputation, in order to be relieved of a limb which was worse than useless.

It is important, therefore, to ascertain the causes which appear likely to lead to this condition, because, although everyone recognises how often broken bones are met with in children, it does not seem to me that they quite realise the ease with which these injuries may be overlooked, without any blame attaching to the practitioner; and, when they are overlooked, how disastrous may be the results of such an error in diagnosis.

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[1] Studies of Old Case-books, London, 1891, pp. 130-135.

The cause of the non-union of fractures in children is always local, and is, I believe, want of rest.

The want of rest may be due to a variety of causes, which may be classified in the following way:—

1. *Errors in diagnosis.*—In children there are many causes which may lead to difficulty in diagnosing a fracture. In the first place, infants may be born with one or more of their bones broken. Mr. Thomas Smith related an interesting example of such a case to the Fellows of the Royal Medical and Chirurgical Society of London.[1] It occurred in the fifth child of perfectly healthy parents, who could never assign a precise cause for the condition. The mother was accustomed to have very tedious labours, but in this instance there had been unusually violent action of the uterus, followed by prompt expulsion of the child early in the course of labour. The baby was brought to Mr. Smith within a day or two of its birth, and on examination all the long bones were found to be broken, so that the least movement of its body caused a grating sensation. As it could not be dressed, it was swathed in Gamgee's dressing, and placed in a sort of tray moulded to its shape. All the fractures united within six months except that of the right femur. This is, of course, an extreme case of congenital fracture, occurring either during or immediately after labour. Similar instances, however, where only a single bone is injured are of no infrequent occurrence. As may easily be imagined, if such a child is entrusted to a nurse of the ordinary type of midwife met with in the country, such an injury is almost certain to be overlooked, with the disastrous results to which I shall presently call attention.

There is another class of congenital fractures which is very liable to be overlooked even when an examination is made by a highly skilled person. In this class of cases the fracture has occurred subperiosteally, or may be of the ordinary green-stick type. Admirable examples of both these classes are preserved in the museum of the medical school attached to the Westminster Hospital. In these cases dissection alone would reveal the injury, and there is no doubt that under ordinary circumstances they would readily be repaired. If, however, the child were to be neglected, or roughly handled, the periosteum might readily be torn through, or the green-stick variety might be rendered complete, when in both cases an ordinary fracture will occur. In such a child, too, the violence necessary to produce this result might be so slight that the fracture might be truly called spontaneous.

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[1] Proceedings, vol. iv., 3rd series, p. 41.

In fat children, again, a green-stick fracture is especially liable to be overlooked by the mother and the doctor, and it is probably not recognised until the production of callus a week or ten days after the injury renders it obvious. It appears from an examination of cases that such cases of unrecognised fractures being allowed to go about without restraint give rise to a certain proportion of the ununited fractures met with in children.

2. *Carelessness* on the part of the child's attendant appears to be a factor in the causation of ununited fracture. This carelessness is usually manifested by delay in calling for skilled advice; this may be from simple callousness, as occasionally seen amongst the class of patients who frequent the out-patient rooms of hospitals; more often, however, mere inattention is the cause of the delay. The child is sent out under the care of a small nurse, who either drops it, or allows it to damage itself in some other way, and is afterwards too frightened to tell the mother on her return home. The mother notices that the child is peevish, but attributes its irritability to general rather than to local causes. If she be unusually observant, she brings the child to the doctor in a

week or ten days' time, saying that it has a "lump," and this on examination proves to be callus, marking the seat of the fracture. If this happens when the fracture repairs, it must, of course, be equally frequent in cases of non-union, and, indeed, in looking through the histories of such cases I have been struck with the constant repetition of the phrase, "The fracture remained for a time untreated," or, which is nearly as common, "it united in bad position, and was subsequently refractured and put up straight, when it failed to unite," in both cases showing that proper care was not taken from the beginning. Carelessness on the part of the parent is often the result of gross ignorance of the simplest laws of domestic surgery, and it is therefore well to give a little simple advice in every case of fracture which is brought under one's notice. In an ideal state every broken bone would be treated under the immediate and constant supervision of a surgeon, but in a large town this is impossible, nor can every child with a broken forearm, or clavicle, or tibia be taken into a hospital. It is well, therefore, to warn the mother after the injured limb has been securely put up in a plaster case or in splints that she must herself look after the child, and see that the apparatus does not loosen, and in the case of the leg, that the child is not placed in a high chair and allowed to dangle its legs. In such a position the two fragments are very soon able to work upon each other with the hinge movement, which Hamilton has shown to be so common a cause of non-union after fracture.[1]

In some cases, too, I am afraid that the medical practitioner cannot be entirely acquitted of all blame. He should remember that it is his duty not only to fix the broken bone, but also to see that the two ends remain fixed. In a fat child and in a restless child it is often extremely difficult to maintain the two fragments in motionless apposition. He should therefore see the child more frequently than is usually necessary in a fracture occurring in an adult, and especially during the second week. A fat child who is confined to bed, or whose movements are restrained, wastes very rapidly, so that bandages or plaster-of-Paris cases, which were at first quite sufficient to render the fragments immoveable, very soon require readjustment. This readjustment, however, must be done with discretion, since there is nothing so fatal to the satisfactory repair of a fracture as constant and needless meddling with the retentive apparatus.

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[1] A Treatise on Fractures and Dislocations, London, 1884, pp. 284-288.

In some cases, too, it would seem as if the surgeon went to the opposite extreme, and simply left the fracture to take care of itself; this mistake is most commonly made in connection with a broken collar-bone, and is, perhaps, one of the reasons why so many instances of non-union are recorded in this bone. Such an error in treatment is also made when a green-stick fracture of the humerus, of the radius, or of the ulna is treated by the simple application of a sling. The child is taken home, allowed to crawl about, and the green-stick fracture is very probably converted into an ordinary fracture before the surgeon again sees it.

Professor Agnew[1] points out that in children the line of fracture is more often transverse than in adults. This point, if true, is of great interest, for it is obvious that it is much more difficult to keep the two ends of a transverse fracture in apposition, than one in which the fracture is oblique. In a transverse fracture the ends would either meet or they would not meet, whilst in an oblique one some part of the ends would be sure to overlap.

The treatment of fractures in children, then, resolves itself into the following common sense rules:—Diagnose the fracture as early as possible, and in every case keep the fragments in perfect apposition. After the fragments have been secured, see that the apposition is maintained by exercising careful supervision, and, when necessary, by the readjustment of the retention apparatus. As in cases of adults, so in children, the most successful treatment of fractures depends upon attention to details. In cases where non-union has occurred the prognosis in regard to subsequent union is very bad. In such cases the ends may be resected, and the fracture treated by securing perfect immobility of the bone for a long period. If, however, there has been much wasting of either end, it will, I think, be found that resection is useless. In the bones of the upper extremity the resulting fibrous union, judiciously aided by a light artificial support, will occasionally enable the patient to pass his life in tolerable comfort. Under similar circumstances in the lower extremity, however, it will often happen that amputation alone affords the patient relief from his miserable condition.

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[1] Op. cit., vol. i., p. 946.